L4: Entry 1 of 18 File: USPT Oct 10, 2000

DOCUMENT-IDENTIFIER: US 6129828 A
TITLE: Apparatus and methods for active biological sample preparation

ABPL:
Systems and methods for the electronic sample preparation of biological materials utilize the differential charge-to-mass ratio and/or the differential affinity of sample constituents to separation materials for sample preparation. An integrated system is provided for performing some or all of the processes of: receipt of biological materials, cell selection, sample purification, sample concentration, buffer exchange, complexity reduction and/or diagnosis and analysis. In one embodiment, one or more sample chambers adapted to receive a buffer solution are formed adjacent to a spacer region which may include a trap or other affinity material, electrophoretic motion of the materials to be prepared being effected through operation of electrodes. In another aspect of this invention, a transporter or dipstick serves to collect and permit transport of materials, such as nucleic acids, most preferably DNA and/or RNA. In one embodiment, a membrane or trap is held in a frame which is adapted to mate with a channel formed in the spacer region. In another aspect of this invention, an electrophoretic system for biological sample preparation is operated in a manner so as to utilize the differential charge-to-mass ratio so as to control the migration of materials within the solution. In one aspect, bunching of selected materials is achieved by operation of two electrodes in a manner so as to reduce the spatial dispersion of those materials. In another aspect of this invention, a vertically disposed sample preparation unit includes an upper reservoir including and a collection chamber. A sample is preferably pre-prepared and densified, applied to the conductive polymer, electrophoresed so as to move nucleic acids into the conductive polymer and move undesired material away from the conductive polymer. Integrated systems are described in which cell separation, purification, complexity reduction and diagnosis may be performed together. In the preferred embodiment, cell separation and sample purification are performed in a first region, the steps of denaturation, complexity reduction and diagnosis being performed in a second region.

BSPR:
In yet another aspect of this invention, a DNA or other nucleic acid purification device is provided. An upper reservoir containing an electrode, which may be identified as a cathode, is adapted to receive a buffer solution and a sample solution. Preferably, the upstream reservoir includes a tube in fluid communication with the upstream reservoir, the tube having an internal diameter less than the diameter of the upstream reservoir. The tube includes at least a first differential mobility section, preferably a gel, which provides a plug or trap region within the tube. Optionally, the gel may be cast on top of a support membrane. A collection chamber is adjacent to the differential mobility region. In the preferred embodiment, the